Multimodal Infrastructure, Transport Networks and the International Relocation of Firms

Bruinsma, F.R.; Gorter, C.; Nijkamp, P.

published in
Transportation Planning & Technology
2000

DOI (link to publisher)
10.1080/03081060008717652

document version
Publisher's PDF, also known as Version of record

Transportation Planning and Technol., Vol. 23, pp. 259–281

Reprints available directly from the publisher
Photocopying permitted by license only

MULTIMODAL INFRASTRUCTURE, TRANSPORT NETWORKS AND THE INTERNATIONAL RELOCATION OF FIRMS

FRANK BRUINSMA, CEES GORTER
and PETER NIJKAMP*

Free University of Amsterdam, Department of Spatial Economics, 1081 HV Amsterdam, The Netherlands

(Received 7 June 1999; In final form 23 February 2000)

This paper outlines the relevance of multimodal transport infrastructure for the locational behaviour of multinational firms. Particular attention is given to foot-loose firms from the viewpoint of desired infrastructural provisions. An empirical analysis is used to highlight the importance of infrastructure networks for long-range freight transport and for policy strategies aiming at coping with the phenomenon of the multinational firm. The results indicate that financial barriers and institutional inertia impede the desired development of intermodal and terminal infrastructure, whereas multinational firms recently settled in the Netherlands experience much less barriers in infrastructural provisions.

Keywords: Transport networks; multimodal transport; infrastructure provision; locational behaviour; multinational firms

1. INTRODUCTION

The modern economy is in a state of flux. Concepts like 'the global village' or 'the network society' exemplify a structural change with profound impacts on traditional patterns of living, working and transporting. This applies to both residential and industrial locations. The present paper will address in particular the dynamic relationship

*Corresponding author.

between changes in transport and infrastructure on the one hand and industrial location on the other hand (see also Vickerman *et al.*, 1999).

The scientific interest in the location of firms and the role that transport infrastructure plays in the spatial pattern of economic activities has a long history. In the 1950s, sector-specific location theories were complemented by more general theories such as integrated theories of interregional trade and regional factor movements (Isard, 1956), the cumulative causation approach (Myrdal, 1957), growth pole theory (Perroux, 1958), and regional development potential theory (Biehl *et al.*, 1975). Finally, Krugman (1991) brought together many elements of these theories, placing emphasis on the role of economies of scale in regional development patterns. In this long theoretical debate transport infrastructure has always played a – more or less eminent – significant role.

A more recent stream of literature on the location behaviour of firms across national borders stems from the theory of multinational firms and their motives to settle in different countries in the world (see for a recent overview, Lagendijk, 1993). Parallel to traditional location theory, the (re)-location behaviour of international firms has been studied intensively by using a micro-approach in which internationalisation is basically due to technology gaps and market failure. This means that specific host countries exhibit technological and locational assets which make them attractive for international firms to invest (foreign direct investments). The favourable locational features can be related to demand factors (opening new markets) or cost factors (cheap inputs, availability resources). And related to these pull factors is the strength of the infrastructural network in the host country, thereby creating the necessary facilities to operate less costly and more efficiently. Given the aforementioned favourable assets in particular countries, it becomes likely that firms will abstain from technology licensing due to information problems or market failures and decide to internalize their foreign production by either creating new production sites or relocating (part of) the current production sites. For multinational firms, Dunning (1988) elaborated his Eclectic Theory on the world-wide relocation process stressing the notions of locational and internalisation advantages by adding as critical factors ownership advantages (related to the firm's assets) and the so-called 'specifities' which can be of a sectoral or national nature. As regards

sectoral specifities, manufacturing and service firms clearly set different priorities in the international relation process and also have different kinds of demands for support by infrastructural networks. To give an illustrative example of national specifities, it is well-known that Japanese firms have a style of investment behaviour that relies heavily on good contacts with local partners and suppliers (see also Nijkamp and Rienstra, 1998), whereas – in contrast – American firms have a strong focus on short-term goals (such as profits).

In this paper, we address the role of transport infrastructure in the international relocation process of firms. What drives companies to go global? What is the role that transport infrastructure will likely play in the struggle to attract foreign companies and to secure their presence? In particular, the focus of the analysis will be on the relative importance of transport infrastructure as a location factor in the decision process of international firms to enter or exit a particular nation (region). Clearly, various factors are crucial in the locational decision process, such as structural changes in the world economy, labour availability and costs, organisational aspects of the firm, legislation and so on. The weights attached to transport (and network) infrastructure will differ between types of infrastructure networks (*e.g.*, multimodal *versus* unimodal, long-distance *versus* local infrastructure, *etc.*) and depend on the sector concerned, the economic activity, the geographical location and the market. Therefore, special attention will be paid in the empirical part of this paper to the valuation of multimodal transport in Europe and the demand for transport infrastructure by different types of international firms.

To highlight these issues this paper starts with identifying the backgrounds of the relocation decisions of firms, placing particular emphasis on the role of transport infrastructure and accessibility (Section 2). Also various empirical illustrations are given. A more detailed analysis of multimodal transport systems and its role in locational behaviour of firms is given in Section 3. Then, Section 4 is devoted to an applied study which serves to map out the importance of various barriers in intermodal freight transport and in transport terminals. This is followed by a presentation of results on locational motives and factors as reported by foreign firms in the Netherlands and of Dutch firms in Poland. The paper concludes with some retrospective and strategic remarks.

2. LOCATIONAL MOTIVES AND FACTORS

The past decade has been marked by an increasing internationalisation of firms. One of the consequences of this mega-trend is that firms are becoming increasingly foot-loose, so that relocation of firms is becoming a common phenomenon, not only within a country but also between countries. To be more precise, we define foot-loose firms as firms with economic activities that are not locationally tied to either the market or source place, have low investments in fixed capital (low sunk costs) and make use of labour intensive production techniques.

In the relocational process of firms we may identify two subsequent phases. In the first initial phase there is a growing awareness that it is – for economic and competitive reasons – necessary to relocate the firm, a process completed by the actual decision to relocate. It should be noted however that the actual move is often carried in a number of subsequent steps. In general, a company starts penetrating a market by hiring a local agent. After a number of sequential steps (outplacement of representatives, starting a sales and/or distribution network), in a final step (part of) the production activities of the company are relocated. It seems reasonable to assume that also foot-loose firms will use a similar strategy, while it seems unrealistic to expect that foot-loose firms will spontaneously start up a new company in a completely unknown environment.

The decision to relocate is usually based on comparative cost calculation. In a trade-off between different cost categories (variable costs, sunk costs *etc.*) it is then decided that it is more cost effective to relocate the whole or part of the company. Although the final decision is mainly instigated by cost calculations, there might be additional underlying motives. For example, many studies (Van Steen and Van der Velde, 1993; Bruinsma *et al.*, 1995) have shown that one of the main motives for firms to relocate is the inability to expand activities at their present location. The cost calculation in those cases concerns then the cost effectiveness of relocating the whole company or to start somewhere else a new plant in which a part of the firm's activities are executed. These decisions are often taken at a low level of spatial aggregation and will lead to a relocation, mostly over short distances.

Clearly, at the higher (international) level of spatial aggregation the decision to relocate is more complex. The main reasons why firms move across the border with subsidiary companies are market expansion (preferably in emerging markets) and cost reduction (Dicken, 1986). World-wide deregulation and liberalisation trends have greatly simplified the possibilities of entering new foreign markets. This market dynamics towards foreign markets has also a reverse side, as firms are also confronted with foreign competitors on their own home markets. To survive in this international competition, firms must grow in terms of market share and size. Large firms are able to reduce the share of their research and development expenditures per product by dividing them over larger product volumes (economies of scope). In addition to growth, a firm has to optimise its production process by cost reductions (economies of scale). The optimisation of the production process generally leads to a relocation of activities over space. International firms reallocate their activities on a world-wide level of aggregation. In this relocation process, firms are restricted by source-related and market-related activities. However, several of these activities are more or less foot-loose and can be undertaken somewhere between the source and the market place. Those foot-loose activities are eligible candidates for relocation behaviour. Significant cost reductions can be realised by out-placement of labour-intensive production processes towards low wage countries such as Eastern Europe, Asia and Latin America. In the context of market-related activities, major cost reductions can be achieved by introducing large-scale distribution networks like European Distribution Centres (EDC). Such activities may also be characterised by relocation behaviour. To reduce the logistic costs, the geographical location in the European infrastructure networks will be of great importance, and this tendency will be reinforced by the move towards component industries and outsourcing.

This increasing globalisation of firm activities is partly made possible by the rapid decrease in transportation costs in the past decades. In the post-war period the volume and quality of transport infrastructure networks, in particular in the First and Second World countries, have increased rapidly and major technological improvements have taken place in all transport modes. This decline in transport costs however, does not mean a decrease in importance of

transport infrastructure in the location of firms. Although the share of transport costs in total production costs is decreasing, it still has a major impact on the relative profitability. Given the strong competition between producers on most other elements of the production process, the role of transport infrastructure as a competitive force seems even to be growing over time.

It is noteworthy that foot-loose activities will not easily settle down (Bruinsma *et al.*, 1997). The freedom to relocate at any time can be suppressed by either large investments in real estate, education *etc.* (high sunk costs), or because the activity is not foot-loose by nature (source or market related). Foot-loose companies try to prevent regional embeddedness not only by low capital investments – as mentioned above-, but also by low institutional embeddedness. Such companies may start a new activity instead of a take-over or merger (both of which may have larger legal consequences in case of a subsequent relocation). In contrast to the desire to penetrate emerging markets, cost reduction is the decisive factor to relocate – some foot-loose part of–the company. Labour-intensive production processes are relocated towards low wage countries, while the assembly of final products is often concentrated in one particular location per continent. By such strategies standard products can be adjusted to continental standards (*e.g.*, value-added logistics in European Distribution Centres). And finally, there is the international dimension: most foot-loose firms are part of an internationally operating network of firms producing for the international market in various ramifications of industrial organisation.

In the second phase – after the decision to relocate is taken – the main concern is on the place where to relocate: which location offers the best opportunities for a new plant of the same company? In this phase not only cost factors are steering the search process, but also less quantifiable factors such as preferences concerning living environment and the image of potential new locations.

There are numerous scientific studies on location factors that play a more or less important role in the final decision where to relocate. We have selected two good representatives in Tables I and II. The Chapman and Walker (1992) example, based on a checklist of location factors as devised by Schmenner (1982) is interesting (Tab. I). This is not only because it shows the most important categories of location

TABLE I Major location factors: information quality and availability

Factor	*Quality of information*
Access to markets	
Distribution cost to existing markets	Estimate
Future trends in sales (including additional sales generated by new plant)	'guesstimate'
Access to supplies	
Assembly costs	Estimate
Future trends in supplies (including new suppliers)	'guesstimate'
Competitive considerations	
Location of competitors	Quantifiable
Reaction of competitors	non-quantifiable
Transport facilities	
Availability, quality and cost of services	Estimate
Utilities and services	
Availability, quality and cost	Estimate
Labour factors	
Availability, quality and cost	Estimate
Taxes and finance	
Prevailing tax rates and obligations	Quantifiable
Tax incentives	Quantifiable
Site factors	
Purchase price and development costs	Quantifiable
Environmental considerations	
Prevailing regulations	Quantifiable
Ease and speed of compliance	non-quantifiable
Community factors	
Community facilities	Estimate
Community attitudes	non-quantifiable
Cost of living	quantifiable

Source: Chapman and Walker, 1992 (adapted from Schmenner, 1982).

factors, but also – and in particular – because it offers information on the precision of the information (in terms of reliability of data) that can be achieved for these categories. This table shows directly the difficulties managers are confronted with by taking a relocation decision to a foreign country. Many data appear to be rather 'soft', so it will be impossible to make reliable comparable cost calculations for a set of potential location sites for several foreign countries the manager is not familiar with. One of the main assumptions in traditional location theory and modelling is that decisions of actors are based on perfect information. This information serves as an input to the actor's objective function to be optimised. However, as Table I indicates, in reality information on locational alternatives will be

TABLE II Essential factors for locating business (in percentages)*

	1990	1992	1994	1996	1998
Easy access to markets, customers or clients	60	62	71	63	66
Transport links with other cities and internationally	57**	49	51	52	62
The quality of telecommunications	59	43	48	46	54
Cost and availability of staff	35	39	40	43	50
The climate government creates for business through tax policies and the availability of financial incentives	30	34	31	36	36
Value for money of office space	24	23	22	26	26
Ease of travelling around within the city	***	22	25	22	21
Availability of office space	27	22	19	22	25
Languages spoken	17	17	16	18	22
Freedom from pollution	***	11	7	11	12
The quality of life for employees	14	10	10	10	13

*'Absolutely essential' responses only are included here,
**Transport infrastructure,
***not asked for,
Source: *Healey and Baker*, European real estate monitor, 1990–1995; *Healey and Baker*, European cities monitor, 1996–1998.

far from perfect; decisions are based on partial information only. Moreover, actors might show satisfying instead of maximising behaviour. Such behaviour has impacts on the actual location decisions of firms, since entrepreneurs are not precisely informed about the pros and cons of all location sites which are interesting for the firm. Empirical research on the spatial knowledge perception of entrepreneurs is limited (Bruinsma and Rietveld, 1997a). The impact of transport infrastructure on the attractiveness of a location as a site is important. When it can be shown that transport infrastructure is one of the critical success factors for the image of a country, it becomes appealing to improve the image by the construction of advanced accessible transport infrastructure.

In an empirical analysis for the Netherlands, Bruinsma and Rietveld (1997a) show that the valuation of 67 Dutch cities by entrepreneurs in the Netherlands as a future location site for their firm is to a large extent explained by the accessibility of these cities to the Dutch road network. From this viewpoint, transport infrastructure performance can be seen as one of the few remaining elements through which national governments can compete with each other to attract foreign

companies within the strict European legislation. Of course, the impact of the construction of transport infrastructure on the image of a country will depend on the already existing infrastructure networks, the type of infrastructure to be constructed and the quality of the network in competing countries (*cf.* Vickerman *et al.*, 1999). A related issue is to what extent the impact of the construction of transport infrastructure on the attractiveness of the country for foreign companies is influenced by the prevailing image of the actors concerning the country in which the infrastructure is constructed.

With the above considerations in mind, in many case studies the relative importance of location factors are measured by entrepreneurial surveys, either interviews or questionnaires. In Table II we present the *Healey and Baker* studies as an example that is interesting, because it concerns the results of an annual questionnaire among over 500 managers of international firms spread over the whole of Europe as far as Norway, Russia and Turkey. The managers are interviewed about their attitudes towards the major business locations in Europe. Although most figures show no clear increasing or decreasing pattern over the years, it is obvious that the impact of transport infrastructure is large in the three categories which are marked most as 'absolutely essential'. *Healey and Baker* (1998) conclude that 'communication issues continue to dominate corporate thinking, followed by cost factors'. As mentioned most factors keep their relative importance roughly at the same level, but with the exception of the factor related to the cost and availability of staff that shows a rise from 35 to 50% in the 1990's. This indicates that labour market considerations are of increasing importance in the decision to locate business.

Many of such rather qualitative studies among entrepreneurs result in findings in the same order of magnitude as presented in Table II. However, which strategic conclusions can be drawn from such 'soft' results? As stated before, the decision to relocate and the decision where to relocate are two separate decisions. The role of infrastructure is in particular relevant in case of the second decision, after the initial decision to relocate is taken. In this setting, transport infrastructure plays an important role as a 'pull' factor of new locations and not as a 'push' factor in the decision to leave the present location. Nevertheless, it is important to have information on the strength of this 'pull' factor

compared to other 'pull' factors. As shown in Table II, this is mostly done in a qualitative manner by assessing and assigning percentages of stakeholders who judge these factors as important or by presenting lists on which location factors are ranked.

With the above considerations in mind, Bruinsma and Rietveld (1997b) have made a quantitative trade-off among business firms between seven locational factors. Their findings were that to keep the initial level of utility constant, a one-kilometre reduction of the distance to the nearest highway interchange should be accompanied by one of the following changes:

- a rise in the price of land of about 7.0 Dutch guilders per square meter (about US$ 3);
- a reduction of an investment subsidy of about 2.5%;
- an increased distance to the most important customers/suppliers of about 3.2 kilometres;
- an increased distance to the nearest large city of about 3.5 kilometres; or
- an increased distance to the nearest railway station of about 7.5 kilometres.

In conclusion, although the share of transport costs in total production costs is relatively low, it still is a relevant share in the profit margin on products and one of the few elements through which producers can compete with each other. Furthermore, the role of transport infrastructure is of particular importance in the decision where to relocate. The impact on the initial decision to relocate seems to be smaller. In other words, transport infrastructure plays an important role as a 'pull' factor and less as a 'push' factor. It should also be noted however that the relative importance of infrastructural provisions at the current location (as a 'keep' factor) of the firm will depend on organisational changes that take place within firms to increase transport efficiency. We have seen in Tables I and II that transport infrastructure plays a significant role in the location behaviour of international firms. However, Rietveld and Bruinsma (1998) argue that data on infrastructure stocks and flows are not sufficient to study properly the infrastructure services. The use of the concept of accessibility is a more appropriate approach to obtain a more

precise view on the potential use of infrastructure. Accessibility is a strategic concept in infrastructure policy. It does not only concern cost savings in relation to efficient transport movements, but also the morphology of the network (such as its structure, the size of the nodes, the linkage pattern of the hierarchical systems *etc.*). Although there is in the literature an ongoing debate on how to define and operationalise the accessibility concept, there is a common view among experts about the need for important spatial data such as the location of nodes, the length of links and data on transport costs. Some operationalisations require additional information on spatial interaction patterns, or parameters of models describing these spatial interactions. But in reality, accessibility is still a fuzzy concept.

Accessibility refers not so much to the fact that a node is linked (cities, industrial sites) to infrastructure networks, but to the fact that the relative – strategic – position of the node within the network (compared to all other nodes linked to the same network) is of great importance (see Bruinsma and Rietveld, 1998). More specific in relation to internationally operating firms is the strategic position the node has in all infrastructure networks which are relevant for a firm producing for an international market. By this we do not only mean a good strategic position within the international transport infrastructure networks (like sea harbours, airports, highways and high-speed rail networks), but also a good connection to local and regional infrastructure networks. For commuting, daily supplies and services, such local and regional infrastructure networks are essential.

3. MULTIMODAL TRANSPORT SYSTEMS

A critical review of transport networks and the accessibility concept has recently been offered from an economic perspective by Martellato and Nijkamp (1998). The authors argue that not so much the physical configuration of a network determines its performance, but the economic potentialities, not only as direct benefits on the user's side but also the long-range spin-offs reflected in the attraction of new firms. Against this background, hubs in a multimodal network are often seen as strategic locations for multinational firms. In the

emerging European network we observe therefore an increasing interest in nodal points of networks, as such points are regarded as the strategic contact and access points into a common market.

Against the background of the increasing awareness of geographical accessibility as a success factor for economic competition, the current Common European Transport Policy (CTP) has three major objectives, *viz* an encouragement of less favoured regions through the supply of European linkage infrastructure, a rise in economic efficiency of the transport market through more deregulation, and liberalisation and the fulfilment of sustainability objectives in the transport sector.

These objectives have to be met in a changing strategic environment, in which the physical shipment of goods and persons is increasingly substituted for value-added processes in all stages of a complex transport and distribution chain (*e.g.*, assembly in nodal points, advanced services deliveries *etc.*). Central nodes in a transport system tend to become places of strategic importance where value added is created. Essentially, networks aim to create value added through synergy by operating *via* nodes in 'real time' (Castells, 1996). Such synergetic forces do not emerge automatically, but require deliberate action and organisation.

Thus, the 'orgware' in such nodal points – based on integrated chains through links and nodes – is of critical importance in translating strategic positions on physical infrastructure into business benefits. In the emerging European transport market, nodal points are becoming extremely important, not only for goods transport but also for passenger transport, and not only at a (supra-) local level but also at a (supra-) national level. The concept of intermodality is of critical importance in this context, in particular in cross-border freight shipment. As the European territory expands by the integration of new countries and as a greater variety and magnitude of raw materials and products are expected to move within this territory, freight transport is going to be either a decisive promoter or a strong barrier to an efficient common market. The direct user transport costs as well as the relevant hidden costs (bottlenecks, congestion, *etc.*) determine to a considerable extent the costs of production and of distribution processes and hence the competitiveness of the European market. In addition, these factors also co-determine the economic effectiveness

of the regional economies within Europe and hence future European development. Furthermore, freight transportation is also decisive for the question whether 'national' firms will become European firms by realising the concept of the 'extended firm', exploring the comparative advantages of each member country in the European Union (Bithas and Nijkamp, 1998).

It is thus noteworthy that the freight characteristics are changing towards valuable and sophisticated products, express delivery, door-to-door delivery, *etc.* So, the transport sector is no longer a single economic activity-agency. It takes the form of a chain of 'value-added' activities that are performed by different actors who utilise the existing infrastructure and offer a reliable service that the user is willing to pay for. It is worth mentioning here that the infrastructure expansion and the restructuring (both in infrastructure and in operation) of transport supply create a new demand in the sector, as we can observe from recent relevant trends. There are in general three characteristics of a modern network that are decisive for its competitive performance. First, the interoperability which refers mainly to operational and technical uniformity, allowing actors and operators to use a network for different simultaneous or sequential purposes. Second, the interconnectivity which is in particular concerned with horizontal coordination and access to the network from different geographical areas. And third, the intermodality which addresses the issue of a combined use of different transport modes in the chain of freight transport.

For the creation of economic synergy in intermodal networks, terminals are of critical importance. Unfortunately, not much empirical evidence is available on the motives and achievements of terminal operators. In our study we have resorted to the use of expert opinion and surveys among relevant firms (mainly based on stated preference methods). These data have a wide European coverage as the interviewees were originating from various European countries.

In a policy context it is of course of great importance to have further insight into the critical success factors that are determining the opportunities of a modern transport network. To the same extent it is relevant to have more insight into the bottlenecks and barriers that prevent an efficient functioning of multi-modal networks. A concise description of some empirical findings will be given in the next section.

4. EMPIRICAL ANALYSIS OF BARRIERS IN INTERNATIONAL TRANSPORT SYSTEMS

In this section we will offer some further empirical evidence along two complementary research lines, *viz.* an investigation on network barriers among transportation experts and an investigation on barriers and opportunities in infrastructure networks as faced by multinational companies.

So, we will first concisely present some results of a Europe-wide survey on barriers in intermodality among a large set of transport experts. The research was undertaken to identify the presence and relative importance of various impediments in intermodal freight transport, in particular in road-rail connections (Bithas and Nijkamp, 1998). Based on a systematic survey questionnaire, a total response of 44 experts was achieved (a response rate of some 75 percent).

The questions concerned the views of these experts on the existence and causes of impediments to a full achievement of economic benefits of intermodal transport. The structure of the questionnaire centred around a test on 5 critical success factors incorporated in the so-called pentagon model (Nijkamp *et al.*, 1994). The critical factors incorporated in the pentagon model are:

- financial or ecoware (costs, benefits, revenues, financing models *etc.*);
- organisational (institutional and managerial capabilities);
- software (information and communication channels);
- psychological (behavioural adjustments and acceptance);
- hardware (technological and engineering sophistication).

This model has been used in many empirical studies and has also been statistically tested in various cases (Capello *et al.*, 1999).

The respondents were asked to rank the importance of each of these five possible barriers to intermodal transport. These barriers were defined as accessibility gaps between existing and desired intermodal transport systems and between existing and desired intermodal transport terminals. These questions were addressed at two geographical levels, *viz.* the national and the European level. The results are presented in a qualitative survey table (see Tab. III). The results from Table III are rather straightforward. The most important impediments

TABLE III Survey of the results

	Crucial barriers	*Medium barriers*	*Low barriers*
Gap between existing and desired intermodal transport. National level	Financial Hardware	Organisational	Software Psychological
Gap between existing and desired intermodal transport. European level	Financial Hardware		Organisational Software Psychological
Gap between existing and desired intermodal terminals. National level	Financial Hardware		Organisational Software Psychological
Gap between existing and desired intermodal terminals. European level	Financial Hardware	Organisational	Software Psychological

TABLE IV Frequencies of dependent variables

	Current intermodal transport compared to the desired level		*Current intermodal terminals compared to the desired level*	
	National	*European*	*National*	*European*
Non-existing	0	0	2	0
Very small	2	0	3	0
Small	10	12	15	12
High	28	22	17	22
Extremely high	4	10	7	10

are apparently financial and to a lesser extent technological factors. Low barriers are formed by psychological and software forces. Organisational barriers assume an intermediate to low position.

The frequencies in Table IV offer some more detail. They represent aggregate expressions of views of the above mentioned aspects on the degree of deviation of the current European intermodal infrastructure network from its desired level. In all cases there appear to be a rather high level of dissatisfaction with the current state of European and national (intermodal and terminal) infrastructure.

Next, we will move to the analysis of micro firm data on the importance of networks. The data in Tables III and IV are still rather aggregate in nature. They map out an average pattern of concern on barriers and of (dis)satisfaction with infrastructure provisions, seen through the eyes of the expert. Clearly, such information has to be complemented with micro data on the perception of individual firms.

An example of such an exercise will now be given. Bruinsma *et al.* (1997) investigate international relocation and the role of infrastructure as a location factor (to attract and to keep firms) by using in-depth interviews of American and Japanese firms that moved into the Netherlands and of Dutch firms that moved into Poland (see for an overview, Tab. V). First, international firms in the Netherlands have been selected from the general business register of the Dutch Chambers of Commerce. All selected companies were characterised by a recent relocation (after 1990). The foreign companies in the Netherlands appear to be service-oriented firms located in the central urban area of the Netherlands (Randstad) and industrial firms located in areas in the vicinity of the Randstad (*cf.* also Nijkamp and Rienstra, 1998). These firms were asked to fill out a survey questionnaire in which they could express their views on the importance of some 40 locational factors for their company as well as the attractiveness score for the Netherlands as a whole on these factors (see for more details, Bruinsma *et al.*, 1997). Second, attention was in particular focused on Dutch firms in Poland, as this country is recently often regarded as a new spring board for Central- and East-Europe. The Polish pilot study was conducted to analyse the impact of Dutch firms relocating toward a region abroad. All Dutch companies interviewed in Poland are located in the Warsaw urban area, which is the major booming area in Poland. These firms were asked to fill out a similar questionnaire on the importance of 40 locational factors comparable to those completed by the foreign firms concerned in the Netherlands.

TABLE V Overview of interviewed international firms

Foreign companies in the Netherlands (12)
–4 North-American service-oriented companies
–2 North-American manufacturing companies
–3 Japanese service-oriented companies
–3 Japanese manufacturing companies
Dutch companies abroad (7)
–3 trade companies in Poland
–2 transport companies in Poland
–2 service-oriented companies in Poland
–1 service-oriented company in England
–1 service-oriented company in Ireland

The in-depth interviews provided insight into (i) the use of transport systems, and (ii) the locational motives of international firms that are recently relocated. But first of all, the survey also gave detailed information on the company (network) structure (see Tab. VI). The network structure of all foreign companies is at least European. The companies appear to be completely new subsidiary companies (with the exception of one case that concerns a take-over of an already existing company). Another common feature is the preference for rented premises by the multinational firms: only one quarter of the firms owns their accommodation.

With regard to the *use of transport systems* and the related transport flows, intercontinental freight flows are transported either by sea or by air. The distribution within Europe takes mainly place by road, except for special deliveries, high value products, and/or spare materials which are often transported by air. Rail and inland waterway infrastructure seems to be, in general, of marginal importance. However, one should remember that none of the surveyed companies generates flows of low-value bulk products; for such products, rail and inland waterway infrastructure is often used. There are however, various differences between foreign companies located in the Netherlands and Dutch companies located in Poland. Whereas American and Japanese firms in the Netherlands generate their own activities and trade flows, Dutch companies in Poland are strongly linked to their Dutch parent company. American and Japanese companies develop their own trade flows for independent producers outside of their network structure. The Dutch companies in Poland are dependent on goods flows which are generated and directed by the parent company. Dutch parent companies appear to collect all inputs and distribute those goods to their subsidiary firms in Poland. This spatial pattern of collection and distribution by the parent company can partially be

TABLE VI Distribution and features of interviewed, international firms

Company structure	*Foreign companies in the Netherlands*	*Dutch companies in Poland*
European network	12	7
world-wide network	12	2
new company	11	7
rented premise	8	5

explained by the company policy to keep stocks in Poland low, because tax and customs rights must be paid immediately at the Polish border.

As regards to *locational motives*, an important difference between American and Japanese companies in the Netherlands on the one hand and Dutch companies in Poland on the other is that the market area of the first set comprises the whole of Europe, whereas the market area of the latter set is mainly in Poland and its neighbours. Only in the long-term do Dutch companies in Poland intend to expand their activities by opening new subsidiary firms in, for instance, Russia. It is also noteworthy that, in general, it may be difficult to attract and maintain internationally operating firms in the Netherlands, since the market area exceeds the domestic area of the Netherlands. The large consumer markets for those internationally operating firms are predominantly Germany, France and the United Kingdom. However, a number of companies stated that from a strategic point of view, it is an advantage to be located in a relatively small consumer market in Europe: none of the large consumer markets can claim that the company is located in their market; and even more important, none of the large consumer markets can complain that the company is located in another large consumer market instead of their own home-market. Thus, from a strategic competitive viewpoint a small country may also have advantages for an international operating firm.

The main aim for the companies investigated to relocate across the border is to expand their activities in an emerging market. However, the entrance of companies into the North-western European market is of a different magnitude compared to the entrance into the East-European market. The Northwest European market is a developed, mature market close to the point of saturation for standard products, whereas the East European market is a young, undeveloped market in a phase of rapid transition. The particular advantages of the Polish market are the relatively stable economic and political climate. The Polish market is also a good frontier market for expanding into other East European markets. Given the above mentioned difference the entrepreneurial demands concerning the location profile of a region are rather diverse. In Poland the entrepreneurs require a stable political, economic, financial – notably currency exchange – climate, and low wages. The underdeveloped infrastructure network, unfavourable

customs facilities, legislation, *etc.*, do not restrain Dutch companies from locating in Poland. With regard to the location in the Netherlands, the prerequisites of American and Japanese companies are much tighter. They indeed make their selection based on a favourable locational profile like legislation, accessibility in all types of infrastructure networks, customs facilities offered, *etc.* When the Netherlands would not be able to fulfil all their wishes, these companies would decide relatively easily to relocate within North-western Europe. The decision to relocate from the Netherlands to countries such as Belgium, Luxembourg, Germany, and even France and the United Kingdom, seems to be easier than the decision to relocate from Poland to a Baltic state, Russia or the Ukraine.

After this discussion of the main findings on the use of transport systems and the importance of location factors, the question arises as to what this means for the design of (Dutch) infrastructure policy. In general, the relationship between international relocation of companies and transport infrastructure has to be seen from two angles. The supply side of infrastructure is of importance in attracting foreign firms to locate in a specific country. The infrastructure supply in the Netherlands is relatively favourable from a European point of view. More important however, is the demand for efficient transportation of goods. Foreign companies locating in the Netherlands will generate transport flows and the input and output flows of these companies will pass through the Netherlands. This generation of transport flows by foreign companies located in the Netherlands will have significant impacts on the volume and the direction of the total transport flows and the use of transport modes in the Netherlands. The reverse effects may show up when companies decide to relocate outside the Netherlands, for instance, towards Eastern Europe or Asia. The related transport flows might then shift in terms of direction of flows (more flows through the eastern part of the country towards Eastern Europe, or more exports instead of imports in sea ports), might change the choice of different transport modes (road instead of inland shipping or rail), or might even bypass the Dutch area (goods are directly transported from the United States towards Poland without trans-shipment in the Netherlands). This all might lead to an underutilisation of the existing and/or planned Dutch infrastructure networks.

The Dutch infrastructure policy, in which – given certain rather strict environmental sustainability conditions – the mainports Rotterdam and Amsterdam are given sufficient opportunities to grow and the main transport corridors from these mainports towards the hinterland are as much as possible be secured from congestion, is in line with the demands of the Japanese and American companies located in the Netherlands. Their goods must be imported by the mainports and distributed throughout Europe mainly by road. The combination of a seaport and an airport located nearby is especially seen as a strategically important location factor. Apart from the Randstad, this combination of two ports of entry within Europe is found only in Belgium and Northern Germany. Nevertheless, the location of Japanese and American companies in the Netherlands is not certain forever; several of these companies regularly evaluate critically their geographical location and accessibility with a view to the European markets.

The trade flows of Dutch companies in Poland continue to be directed by the parent company in the Netherlands. The transport flows to Poland use mainly the road, although the Polish road network is of a poor quality. Only high-value goods are transported by air. This observation underlines the importance of efficient road transport corridors from the Netherlands towards the rest of Europe. However, the Dutch parent companies often extract their inputs from the world market. The distribution towards the subsidiary companies takes then usually place afterwards by road transport.

We may thus conclude that both foreign companies in the Netherlands and Dutch firms abroad highlight the relevance of current Dutch infrastructure policy, in which much emphasis is laid on mainports and their hinterland connections.

5. CONCLUDING REMARKS

The aim of an integrated European community is – apart from many economic and political desirabilities – strongly connected with transport potentials within Europe. Besides, transport is to a large extent responsible for environmental, accessibility and other externality problems; the relevant current trends are not promising for overcoming

these problems. Given the capacity of the current European networks for commodity transport in an integrating economy and in the light of the unacceptably high environmental stress of road transport, new logistic systems based on combined transport as a blend of different modalities are necessary. This will increase capacity, reduce congestion and environmental decay, and make the European network economical by itself.

In recent European transport policy, a great deal of attention is given to sustainable transport and intermodality. But the way towards real value-added networks based on interoperability, interconnectivity and integrated logistic chains is still long and full of obstacles. This gap between desired and current level of intermodal transport and transhipment terminals in Europe exists because attempts to fill it encounter – according to transport experts – financial barriers and institutional inertia in its goal of competitive action in the transport market. The perceived barriers in transport infrastructure at the firm level are apparently less severe, but do show that American and Japanese firms in the Netherlands critically (re-)assess their locational profile in an European context. It becomes clear that transport infrastructure is one of the important factors in this ongoing evaluation process, next to other location factors, such as quality of life, labour market conditions, cost levels, *etc.* Even though in some cases it may seem that the quality of the transport infrastructure network is of decisive importance, the actual location decision is normally based on a broad set of locational factors which determine the entrepreneur's choice. In a saturated competitive market, 'soft' location factors such as local image and local policy might be particularly important. It might be attractive in such a market to link infrastructure advantages of a given geographical site to economic and psychological image factors of that location. By offering such an integrated package of services, foot-loose multinational firms might be convinced to demonstrate a more stable locational pattern.

References

Biehl, D., Hussman, E., Rautenbach, K., Schnijder, S. and Sudmeyer, V., 1975, *Bestimmungsgrunde der regionale entwicklungspotentials*, Mohr, Tubingen.

Bithas, K. and Nijkamp, P., 1998, Critical Factors for a Freight Transport Network, *Innovation*, pp. 234–258.

Bruinsma, F. R. and Rietveld, P. (1997a) The impact of accessibility on the valuation of cities as location for firms, In: Egeln, J. and Seitz, H. (Eds.), *Stadte vor neuen Herausforderungen*, Nomos, Baden-Baden, pp. 189–217.

Bruinsma, F. R. and Rietveld, P. (1997b) A stated preference approach to measure the relative importance of location factors, *International Journal of Development Planning Literature*, **12**, 125–140.

Bruinsma, F. R. and Rietveld, P., 1998, The accessibility of European cities: theoretical framework and comparison of approaches, *Environment and Planning A*, **30**, 499–521.

Bruinsma, F. R., Rienstra, S. A. and Rietveld, P., 1995, *De structurerende effecten van infrastructuur op interregionaal niveau langs verbindingsassen: een ondernemerssurvey*, Projectbureau IVVS, Den Haag.

Bruinsma, F. R., Gorter, C. and Nijkamp, P., 1997, *En de karavaan trok verder.....*, Adviesdienst Verkeer en Vervoer, Rotterdam.

Capello, R., Nijkamp, P. and Pepping, G., 1999, *Sustainable Cities and Energy Policies*, Springer Verlag, Berlin.

Castells, M., 1996, *The Rise of the Network Society*, Oxford University Press, New York.

Chapman, K. and Walker, D. F., 1992, *Industrial location*, Basil Blackwell, Oxford.

Davidson, P., 1995, *Netwerkvorming in de Vliegtuigindustrie*, Unpublished Master's thesis, Dept. of Economics, Free University, Amsterdam.

Dicken, P., 1992, *Global Shift*, Paul Chapman, London.

Dunning, J. H., 1988, *Multinationals, Technology and Competitiveness*, Urwin Hyman, London.

Hakansson, H. (Ed.) (1987) *Industrial Technological Development: A Network Approach*, Croom Helm, Andover, Hants.

Healey and Baker, *European Real Estate Monitor*, Healey and Baker, London, 1990–1995.

Healey and Baker, *European Cities Monitor*, Healey and Baker, London, 1996–1998.

Hinterhuber, H. H. and Levin, B. M., Strategic Networks, *Long Range Planning*, June, 1994, pp. 43–58.

Isard, W., 1956, *Location and the Space-economy*, MIT Press, Cambridge.

Kamann, D. J. and Nijkamp, P., 1991, Technogenesis, *Technological Forecasting and Social Change*, **39**, 35–46.

Krugman, P., 1991, *Geography and Trade*, MIT Press, Cambridge.

Lagendijk, A., 1993, *The Internationalisation of the Spanish Automobile Industry and its Regional Impact*, Thesis Publishers, Amsterdam.

Martellato, D. and Nijkamp, P., 1998, The Concept of Accessibility Revisited, In: Reggiani, A. (Ed.), *Accessibility, Trade and Locational Behaviour*, Ashgate, Aldershot, pp. 17–40.

Myrdal, G., 1957, *Economic Theory and Underdeveloped Regions*, Duckworth, London.

Nijkamp, P. and Vermond, N., 1996, Scenarios on Opportunities and Impediments in the Arian Pacific Rim, *Studies in Regional Science*, **11**(3), 1–46.

Nijkamp, P. and Rienstra, S., 1998, Internationalization and Localization. A Double-Edge Sword, Free University *Research Memorandum 98-27*, Amsterdam.

Nijkamp, P., Rienstra, S. and Vleugel, J., 1998, *Transportation Planning and the Future*, John Wiley, Chichester/New York.

Nijkamp, P., Vleugel, J., Maggi, R. and Masser, I., 1994, *Missing Transport Networks in Europe*, Avebury, Aldershot.

Perroux, F., 1958, *La Coexcistence Pacifique*, Presses Universitaires de France, Paris.

von Raesfeld Meyer, A., 1997, *Technological Cooperation in Networks*, Unpublished Ph.D. thesis, Twente University of Technology.

Reggiani, A., Nijkamp, P. and Bolis, S., 1997, The Role of Transalpine Freight Transport in a Common European Market, *Innovation*, **10**(3), 259–275.

Rietveld, P. and Bruinsma, F. R., 1998, *Is Transport Infrastructure Effective? Transport Infrastructure and Accessibility: Impacts on the Space Economy*, Springer Verlag, Berlin.

van Steen, P. J. M. and van der Velde, B. M. R., 1993, Expansieruimte voor bedrijven, Onderzoek en Advies 69, Rijksuniversiteit Groningen, Groningen.
Thorelli, H. B., 1986, Networks: Between Markets and Hierarchies, *Strategic Management Journal*, 7, 37–51.
Vickerman, R., Spiekermann, K. and Wegener, M., 1999, Accessibility and Economic Development in Europe, *Regional Studies*, 33(1), 1–16.
Williamson, O. E., 1979, *Markets and Hierarchies*, Free Press, New York.